# Discussion and Application of long-term corrosion/scale inhibitor technology for low-permeability oil fields

Chunsheng Wu, Qiongwei Li, Keting Feng, Huiying Yuan, Gang Guo, Kai Li，Hui Li, Le Yang

[a] National Engineering Laboratory for Exploration and Development of Low Permeability Oil and Gas Fields, Xi'an, 710018, P. R. China

[b] Oil and Gas Technology Research Institute, Changqing Oilfield Company, PetroChina, Xi'an, 710018, P. R. China

Based on the condition of low liquid volume per well and a large amount of wells in the low-permeability oilfields, corrosion/scale prevention for carbon steel tubing and casing need technologies balancing the relationship between economic and technical requirements. A series of technical research and experiments have been applied, including solidification, micro-encapsulation, and downhole controlled release tools for corrosion/scale inhibitors. The experiments were conducted to evaluate the long-term controlled release and corrosion/scale inhibition effect of solid particle corrosion/scale inhibitors under different medium and production conditions. After optimization and improvement of formula and processes, a series of long-term corrosion/scale inhibition technologies were developed for different types of oilwells(Table 1), and 10 related invention patents and 3 standards were obtained, .

From 2019 to 2023, this technology system has been applied in more than 2000 wells. By tracking and detecting the residual concentration of chemical agents in the produced fluid, effective period of long effective controlled release inhibitors for single-injection can achieve 3 months, which provides a new economic and technical direction for downhole corrosion/scale protection.

The key research directions have been proposed for the subsequent steps:

1. Research on the mechanism and laws of controlled release in solid systems;

2. Simulation and model research on production dynamic release for different types of wells;

3. Products efficient processing and quality control technology, and multi-functionality;

4. Rapid detection and tracing technology of effective concentration on field;

5. Green compound corrosion/scale inhibitor.

Table 1.

| Technical sequence | Types | Molding method | Applicable wells | Scale prediction |
|---|---|---|---|---|
| 1st | Solid rod/block | Squeezing into Blocks+Tools | Low corrosion and scaling wells | 300 wells/ year |
| 2nd | Solid granular | Blended extrusion granulation | Jurassic formation wells, 4 times/year | 1000 wells, 1200 t/year |
| 3rd | Dispersed soft capsule | emulsion polymeriza -tion and film curing | Annulus with high pressure wells, injection via pumps, 4 times/year | 1000 wells, 400 t/a |
| 4th | Release control combination tool | Solid inhibitors+ controlled release tool | <1 time/2 years | All kinds of wells |